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Evaluation of the Military Functional Assessment Program: Preliminary Assessment of the Construct Validity Using an Archived Database of Clinical Data

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14. ABSTRACT

There is a critical need for return-to-duty (RTD) assessment criteria that encompasses the spectrum of injury and disease experienced by U.S. Soldiers, Airmen, Sailors, and Marines. This study focused on injury effects on human neurosensory and musculoskeletal function, including those resulting from blast, blunt, and ballistic threats. The goal of this effort was to evaluate the relationships between clinical assessments and novel military-specific tasks of current assessment batteries by comparing scores on a clinical test battery with Soldier performance on the tasks currently utilized by the Military Functional Assessment Program (MFAP) at Fort Campbell, Kentucky. Results demonstrated an initial convergent validity between MFAP tasks and clinical assessment scores, and supported additional research efforts to determine the effectiveness of the MFAP in predicting RTD success.
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SF 298 Abstract (continued)

Additional survey data collected from a sample of military leaders indicated that Soldiers reintegrating with a unit following medical treatment at the Warrior Resiliency and Recovery Center are generally perceived as successful, but require special treatment to carry out their missions; however, interpretations and application of survey data were limited by the small sample size of respondents.

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Introduction

There is a critical need for return-to-duty (RTD) assessment criteria that encompass the spectrum of injury and disease experienced by US Soldiers, Airmen, Sailors and Marines. Effective RTD screening tools must balance traditional clinical diagnostic techniques with applied military tasks in order to inform decision-makers about not only whether an injury has significantly impacted a service member, but also whether or not the service member can effectively carry out the tasks required by their military occupational specialty (MOS). A number of military treatment and recovery centers have developed their own RTD screening tools, but there has been little evaluation of their effectiveness, and system-wide best practices for developing and utilizing these tools do not exist. The investigators' current research is aimed at providing Army-wide evidence-based criteria for standards to determine the level of operational competence and performance of a Soldier after neurosensory injury resulting from blast, blunt, and/or ballistic trauma. The present study focuses on evaluating the Military Functional Assessment Program (MFAP) at Fort Campbell, Kentucky; specifically, investigators hoped to evaluate the relationships between validated clinical assessments and the MFAP's novel military-specific tasks.

Background

Approximately 5-15 percent of individuals with mild traumatic brain injury (mTBI) have persistent symptoms and/or functional limitations (Iverson, Zasler, & Lange, 2006; Ruff, Camenzuli, & Mueller, 1996). Psychological and behavioral symptoms include depression, anxiety, fatigue, aggression, personality changes, emotional volatility, and reduced motivation/apathy. Cognitive changes related to mTBI may include deficits in memory, attention, concentration, judgment, and decision-making. Physical symptoms include visual and vestibular alterations, as well as headache and sleep disturbances (Ryan & Warden, 2003; Drew et al., 2007; Scheibel et al., 2007; McAllistar et al., 2001; Nicholson & Martelli, 2006; Lachapelle & McKerral, 2005; Stulemeijer et al., 2006). While researchers have examined the effects of these symptoms on the general population, the extent to which mTBI affects specific polysensory and neuropsychological processes required for critical Soldier occupational skills remains unclear.

Return-to-duty decision making

Medical and other expert opinion currently provide the primary RTD criteria for core physical requirements for most MOSs; however, occupation-specific cognitive abilities (e.g., decision-making) and advanced skills necessary for complex interactions in the military environment are largely unknown. Traditional clinical assessments and rehabilitation efforts for mTBI patients do not generally include underlying aspects of military performance that may have significant negative effects on a Soldier's physical or cognitive abilities. For example, the lingering effects of concussive injury may not be evident except in a stressed environment involving high workload, fatigue, or sleep deprivation; post-concussion reduced binocular fusion ability could negatively affect safe use of advanced helmet-mounted displays; and post-laser injury scotomata may have a negative effect on target acquisition. Such compromising effects

may be subtle yet long lasting. Newly-developed standardized measures are being used by military TBI treatment clinics to assist with the RTD decision process. Of particular interest are RTD measures which take into account basic Soldier skills, such as Military Vehicle Egress, Reactive Hostile Fire, and Squad Tactical Formations. Performance on these measures relies on the functioning and integration of multimodal sensory input, motivation and cognitive processes, proprioception, and relevant behavioral responses over time.

The significance of the present study lies in the need for research aimed at providing evidence-based criteria for standards to determine the level of operational competence and performance of a Soldier after injury. RTD assessment criteria must include the spectrum of injury and disease experienced by U.S. Soldiers, Airmen, Sailors, and Marines. Research to address such criteria is currently focused on injury effects on human neurosensory and musculoskeletal function, including those resulting from blast, blunt, and ballistic threats. General Warfighter abilities include those essential to all military occupations (e.g., Soldier Common Tasks), while specific Warfighter abilities are special skills or enhanced abilities required to perform different occupations in the military (e.g., binocular vision or hearing acuity required to interact with a military system/machine, enhanced spatial ability required of an aviator). RTD methods and standards are needed far-forward on the battlefield to enable medics or leaders to decide if a Soldier is fit for duty immediately following a potential TBI (e.g., blast exposure or concussion with potential hearing loss and subclinical balance problems); however, RTD standards are also necessary for the military training environment (where many musculoskeletal injuries occur) and in the medical administrative setting where various retention boards determine long-term retention in the military, physical profiling, and/or reclassification to another MOS.

The successful re-integration of the Wounded Warrior with physical and/or psychological injuries into his/her operational units and military occupation requires top notch medical care, and the establishment of valid, evidence-based, occupationally specific RTD criteria. The task of establishing such RTD standards poses common scientific challenges that generalize to several classes of trauma. The essential requirements of key military occupations must be matched to likely injury effects.

Predicting return-to-duty success

A core aspect of effective RTD decision-making is the ability to accurately predict success once Soldiers return to active duty after an injury. Assessing the predictive validity of any assessment strategy presents a challenge to researchers, as universal standards defining success following re-integration do not currently exist. Leadership plays a major role in post-RTD success, as determination of Soldier fitness and ability is largely based upon observations and ratings from commanding officers. Basic skills and common tasks outlined in the Soldier's Manual of Common Tasks (Department of the Army, 2012) provide guidance to leaders in making their decisions, but these are generally viewed as simple guidelines, do not account for differences in critical job tasks by MOS, and provide little formal structure in the overall consideration of Soldier performance. Initial attempts to create standards for RTD success will first require development of standards for general Soldier performance based on existing performance evaluation methods (which rely extensively on narrative rationale for categorical

ratings) (Department of the Army, 2012). A natural starting point for this effort will include performance ratings and a general survey of opinions and experiences from Army leadership, as their ratings are the current foundation for all documented Soldier successes and failures. Establishing connections between standardized military performance ratings and clinical assessment outcomes will provide a strong foundation for predicting how specific symptoms and deficits will affect Soldier performance during active duty and/or combat.

The Military Functional Assessment Program

The Blanchfield Army Community Hospital Warrior Resiliency and Recovery Center (WRRC) at Fort Campbell, Kentucky, has been treating and rehabilitating injured Soldiers since 2008. In Fiscal Year (FY) 2008, the center treated 771 patients, 1314 patients in FY 2009, 1552 patients in FY 2010, and 2095 patients in FY 2011 (through 27 June) (Personal communication from Dr. Bret Logan, Director, NICOE Satellite Fort Campbell, January 2012). The top ten diagnoses are post concussive syndrome, post traumatic stress disorder, headache syndromes, mild cognitive impairments, visual disturbance, memory loss, dizziness and giddiness, adjustment disorder with anxiety, obstructive sleep apnea, and concussion with coma. Upon treatment completion, Soldiers who wish to RTD are tested on a battery of military-relevant tasks to aid in determining their readiness to RTD (see table 1). The tasks were selected and modified from the Soldier's Manual of Common Tasks, and were chosen based on their ability to best simulate combat scenarios while measuring established cognitive constructs adopted from the Neuropsychological Assessment Battery (Helmick, 2012; Personal communication from Dr. Theresa Benchoff, Medical Director, NICOE Satellite Fort Campbell, May 2013). These tasks comprise the MFAP; the results of this end-of-treatment assessment battery, although helpful in determining Soldier fitness for duty, have yet to be evaluated for convergent statistical validity.

Table 1.
MFAP tasks and descriptions.

Task Name	Description
Tactical Combat Casualty Care (TCCC)	Perform basic life support
Warrior Task Battle Drill (WTBD)	Perform a series of military physical tasks and drill and ceremony procedures (e.g. donning gas mask and Mission-Oriented Protective Posture suit, completing a casualty evacuation simulation)
High-Mobility Multipurpose Wheeled Vehicle (HMMWV) Egress Assistance Training (HEAT)	Egress from a simulated HMMWV roll-over
Land Navigation Preparation (LNP)	Prepare for a land navigation task
Virtual Convoy Operations Trainer (VCOT)	Complete virtual reality simulation in convoy trainer, including SALUTE report and identification of RPGs and IEDs
Land Navigation (LN)	Execute prepared land navigation task
Engagement Skills Trainer 2000 (EST) – Weapons Qualification	Zero a weapon and complete standard qualification
EST - Shoot/No-Shoot Scenarios	Complete interactive scenarios with the marksmanship trainer

Table 1. (continued)

Medical Simulation Training Center (MSTC) - Mass Casualty Scenario	Complete virtual reality simulation in medical trainer, providing medical assistance for a large-scale casualty
MSTC - Tactical Mission Scenario	Complete virtual reality simulation in medical trainer for IED obstacles
Ropes Confidence Course	Complete an elevated obstacle course

The objective of this study was to evaluate the relationships between clinical assessment outcomes and ratings of performance on the MFAP tasks. It was also hypothesized that Soldiers who passed the MFAP would score significantly more favorably on the clinical assessments than those who failed the MFAP. A secondary objective was to develop a generalized understanding of how a Soldier's local chain of command (from squad leaders to brigade commanders) perceive the success of those treated at an WRRC and subsequently returned to duty.

Methods

The protocol for the present study was reviewed and approved by the U.S. Army Medical Research and Materiel Command Institutional Review Board (USAMRMC IRB) prior to implementation. Clinical assessment outcomes and ratings of performance on the MFAP tasks were archived in a de-identified database made available to the research team by the WRRC. No new patient data were collected and analyses were applied to the archived dataset. As a first step to assessing the value of the MFAP in predicting RTD success, an anonymous supervisor questionnaire was administered by USAARL research personnel to random Fort Campbell unit leaders at all command levels (from squad leaders to Brigade Commanders) to capture how leadership perceives the success of those treated at an WRRC and subsequently RTD. No Fort Campbell WRRC personnel participated in the administration of the leadership surveys.

Database

The database contained information on a total of 79 cases (77 of which were male). The number of concussive events experienced by each individual ranged from 1 to 15 with a median value of 2. Frequencies of diagnoses and symptoms are presented in table 2. Fourteen of the cases indicated a prior mental health diagnosis; conditions included depression, anxiety, and anger management. The majority of the cases had deployed to Afghanistan; however, not all injuries occurred during combat. Other demographic data identifiers were not included in the database. All metrics included in the present analysis were administered as a standard component of the established MFAP process.

Table 2.
Frequencies of diagnoses and symptoms.

Diagnosis/symptom	Frequency
Traumatic brain injury	54
mild TBI	*7*
penetrating TBI	*2*
unknown severity	*7*
Headache	15
Memory loss	17
Depression	2
Anxiety	3
Post Traumatic Stress Disorder	1
Post Concussive Syndrome	4
Stroke symptoms	1
Vertigo	1

Note. Diagnostic information was reported for only 58 of the 79 cases in the database. Those patients not diagnosed with either TBI or Post Concussive Syndrome were referred to the WRRC for symptoms related to a concussive event.

Clinical assessments

Physical therapy

Clinical assessments were administered by physical therapists for all MFAP patients, and scores were recorded in the database. The standard MFAP physical therapy assessment battery included the following: Dizziness Handicap Inventory (DHI), a 25-item self report measure of the impact of dizziness on everyday life (Jacobson & Newman, 1990); Dynamic Visual Acuity (DVA), an objective measure of overall vestibular functioning as it relates to the vestibule-ocular reflex (Goebel, White, & Heidenreich, 2009); and the Sensory Organization Test (SOT), which objectively measures degree of postural control (Goebel, White, & Heidenreich, 2009).

Occupational therapy

The standard MFAP occupational therapy assessment scores recorded for each case in the database included: Patient self-reported occupational performance; the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), an objective battery of cognitive abilities (McKay, Wertheimer, Fichtenberg, & Casey, 2008); and the Comprehensive Trail Making Test, an objective measure of visual search and sequencing sensitive to deficits in attention, psychomotor speed, and visual search (Moses, 2004).

Mental health

The standard MFAP mental health assessments included in the database were: Beck's Depression Inventory (BDI), a 21-item self report measure of depression severity (Beck, Steer, & Garbin 1988); Beck's Anxiety Inventory (BAI), a 21-item self report measure of anxiety severity (Beck & Steer, 1993); and the PTSD checklist military version (PCLM), a 17-item self report measure of severity of PTSD symptoms (Bliese et al., 2008). The BDI and BAI were administered at two time points, pre- and post-treatment. The PCLM was only administered pre-treatment.

Additional measures

The database also contained additional measures that were recorded pre-treatment. These include the Alcohol Use Disorders Identification Test (AUDIT), a 10-item self report screening tool for alcohol related problems (Babor et al., 2001); the Epworth Sleepiness Scale, an 8-item self report measure of daytime sleepiness (Johns, 1991); the Patient Health Questionnaire, a multiple-choice self-report inventory, used as a screening and diagnostic tool for depression, anxiety, alcohol, eating, and somatoform disorders (Blacker, 2009); and the Military Acute Concussion Evaluation (MACE), a concussion screening tool for the far-forward assessment of service members involved in a potentially concussive event (Center of Excellence for Medical Multimedia, 2013).

Military Functional Assessment Program Performance

Upon completion of their individual treatment program, each patient participated in the military assessment component of the MFAP, which is composed of 10, rated tasks and an unrated ropes course completed over a period of 5 to 6 days. All tasks were graded by four raters that included a military representative (Mil), who was typically a non-commissioned officer; a physical therapist (PT); and an occupational therapist (OT). A mental/behavioral health professional (MH/BH) rated performance on 7 of the 11 tasks. Tasks were rated based on the patient's level of independence demonstrated throughout task completion using a 5-point scale for clinical raters and a 4-point scale for the military representative (see figure below). The degree of dependency corresponded to the level of assistance needed to accomplish the task. For example, an acceptable level of assistance is described as "the SM [required] no more than 2 direct verbal cues without physical contact."

WRRC MILITARY FUNCITONAL ASSESSMENT PROGRAM
Discipline-Specific Assessment Criteria

1—Independent	
OT	SM is able to complete all of the tasks making up the activity safely, without modification, and within reasonable time.
PT	No balance deficits noted during the task. No abnormal findings on post assessment or no decrement from pre assessment.
BH	No anxiety observed or anxiety observed did not impact task performance.
2—Modified Independent	
OT	SM requires increased time to complete tasks (within functional limits), use of compensatory strategies/techniques, indirect verbal or visual cues, OR SM requires that task be modified due to physical profile.
PT	Minimal balance deficits noted that do not impact ability to perform task and/or one decrement in findings from pre to post assessment.
BH	Visible signs of anxiety present: perspiration, hands trembling, did not disengage from the task; completed task.
3—Acceptable Level of Assistance	
OT	Acceptable Level of Assistance – SM requires no more help than 2 direct verbal cues without physical contact. SM performs at a level that is acceptable based on rank/experience. Will benefit from additional training.
PT	Moderate balance deficits noted that causes slight alteration of task performance and/or rest, but task completed to standard and/or two decrements in findings from pre to post assessment.
BH	Anxiety observed. SM rated anxiety 3 or above, symptoms appeared to impact concentration, task performance and completion; SM continued to manage symptoms and proceeded with the task. SM confronted symptoms of anxiety vs. engagement in avoidance.
4—Unacceptable Level of Assistance	
OT	SM requires 3 or more direct verbal cues; SM requires that part (less than 25%) of task be completed for him/her by clinician; SM performs at a level that is unacceptable based on his/her rank and/or experience.
PT	Balance deficits and/or dizziness require SM to need rest breaks > 1, or causes task to be completed below standard and/or falls noted during task or during post assessment.
BH	On site Psychological Intervention Required: EMWave personal stress reliever utilized to manage symptoms for task completion / RTD segment discontinuation.
5—Dependent	
OT	SM requires that 25% or more of task by done for him/her by clinician; SM unable to complete task due to physical restrictions/limitations.
PT	Balance deficits and/or dizziness do not allow SM to complete task.
BH	Clinician observations of Anxiety levels, SM self reported levels of anxiety prevented task completion; referral to Mental Health or Mental Health Treatment Continuation.

Operational Criteria: To Be Completed By Active Duty Coordinator	
A	SM is able to complete all task without any direct or indirect cues, and within a standard time frame (Exceeds Course Standards).
B	SM requires increased time to complete task and/or <2 direct cues and/or <2 indirect cues. SM performance is acceptable based on his/her rank and/or level of experience (Meets Course Standards).
C	SM requires significantly increased amount of time to complete task and/or <3 direct cues and/or < 3 indirect cues. SM will benefit from additional training (Marginally Achieves Course Standards).
D	SM unable to complete task within acceptable time frame and/or requires ≥3 direct cues and/or >3 indirect cues. Performance is considered unacceptable based on his/her rank and/or experience (Failed to Meet Course Standards).

Figure: WRRC MFAP Scoring Criteria

In addition to task-specific scores, all raters collaborated on a single Overall Level of Independence (Overall LOI) score, and the mental health rater provided a Mental Health LOI (MH LOI) score. Each of these total scores was determined based on the 5-point rating scale provided in the figure above.

Statistical analysis

Given the nature of this database as a collection of clinical assessments performed on an "as indicated" basis, there are a number of missing values. Specifically, if a case tested within normal limits on a clinical assessment pre-treatment, then this assessment was unlikely to be administered post-treatment, thus leading to an empty cell in the database. The number of cases included in each statistic is explicitly stated in the following presentation of the results, and is also reflected in the degrees of freedom for statistical tests. Descriptive statistics were first calculated to characterize the database sample. To explore the construct validity of the MFAP, Spearman's rank correlations between MFAP task ratings (ordinal data) and, when available, post-treatment clinical assessment scores (interval data) were calculated. Additional non-parametric tests were used to evaluate differences in performance between those who passed the MFAP versus those who failed. Non-parametric tests were necessary due to the extreme differences in group size between those who passed and those who failed. Frequencies and descriptive statistics were calculated to summarize the leadership survey data.

Results

Descriptive statistics of MFAP data

Of those who completed the MFAP (*N* = 72), 13 cases failed (approximately 18 percent) and were not recommended for RTD. The percentage of failures for each MFAP task is included in table 3.

Table 3.
Percentage of failures for each MFAP task.

Task	No. of failures	Total no. of cases	Percent (%)
TCCC	4	69	5.79
WTBD	6	69	8.69
HEAT	4	69	5.79
LNP	10	60	16.67
LN	15	70	21.42
VCOT	10	71	14.08
EST WQ	21	70	30.0
EST CSS	6	71	8.45
MCS	12	71	16.90
TMS	7	69	10.14

Descriptive statistics of clinical assessment data

Mean and standard deviations were calculated for the clinical assessment data (presented in table 4). In the database, 61 cases included physical therapy clinical data. Of those cases, the most common findings were dizziness (*N* = 53 [86.89 percent]) and balance deficits (*N* = 39 [63.93 percent]). End-of-treatment diagnosis information was provided for 44 cases, of which 41 were reported as resolved. The occupational therapy personnel reported the percentage of goals met for 42 of the cases, with a mean of 86.26 percent of goals met (*SD* = 19.08). The most common deficits at initial evaluation in this domain were memory loss (47.5 percent) and attention (65 percent).

Table 4.
Descriptive statistics for clinical assessment data.

Assessment/Performance metric	*N*	Mean	*SD*
Physical therapy			
Dizziness Handicap Inventory			
Pre	55	28.29	21.25
Post	55	19.44	17.87
Sensory Organization Test			
Pre	43	65.47	11.89

Table. 4 (continued)

Post	43	81.84	5.47
Dynamic Visual Acuity – Left			
Pre	38	0.24	0.14
Post	38	0.13	0.09
Dynamic Visual Acuity – Right			
Pre	38	0.27	0.19
Post	38	0.13	0.08
Occupational therapy			
Comprehensive Trail Making Test – Overall			
Pre	52	41.79	8.77
Post	52	51.52	9.44
Repeatable Battery for the Assessment of Neuropsychological Status – Total Score			
Pre	50	81.68	10.86
Post	50	93.40	12.43
Self-reported Occupational Performance			
Pre	47	4.56	1.26
Post	47	6.74	1.55
Mental health			
Beck's Depression Inventory			
Pre	49	15.90	9.18
Post	49	8.84	8.17
Beck's Anxiety Inventory			
Pre	50	15.48	12.34
Post	50	7.42	9.29
PTSD Checklist Military Version	74	23.28	15.39
Additional measures			
AUDIT	73	2.59	2.26
MACE	74	24.51	3.38
Epworth Sleepiness Scale	74	8.55	4.92
PHQ	74	9.04	5.45

Correlational analysis

Spearman's rank correlation coefficients were calculated between clinical assessment scores and ratings on the MFAP (for each task). Task ratings and clinical assessment scores that were significantly correlated (p= .05) are presented in table 5.

Table 5.
Correlations between MFAP task ratings and clinical assessments.

Task	Rater	Clinical Assessment	Correlation Coefficient	*N*	*p*
TCCC	Mil	RBANS total	-0.59	25	0.002
	OT	RBANS total	-0.41	51	0.003
		SROP	-0.32	43	0.040
		Epworth score	-0.38	66	0.002
HEAT	PT	BDI	0.44	43	0.003
		AUDIT	-0.26	64	0.038
	OT	RBANS	-0.52	48	< 0.001
	MH	BAI	0.38	30	0.036
		BDI	0.62	30	< 0.001
		DHI	0.49	33	0.004
		SOT	-0.47	25	0.017
		RBANS	-0.41	34	0.016
		SROP	-0.38	33	0.032
		PCLM	0.40	46	0.006
		PHQ	0.41	46	0.005
WTBD	Mil	CTMT	-0.45	25	0.025
		RBANS	-0.57	22	0.015
	PT	BDI	0.46	40	0.003
		DHI	0.37	46	0.013
		PCLM	0.27	61	0.034
		PHQ	0.28	61	0.032
	OT	CTMT	-0.53	46	< 0.001
		RBANS	-0.40	41	0.005
		SROP	-0.40	41	0.010
EST WQ	Mil	DVA Right	0.56	23	0.006
	MH	DHI	0.40	36	0.015
		SOT	-0.40	27	0.042
		RBANS	-0.35	39	0.027
		PHQ	0.40	50	0.005
VCOT	Mil	BDI	0.44	28	0.019
		DVA Left	-0.41	24	0.045
		DVA Right	-0.49	24	0.014
		PCLM	0.38	39	0.016
		PHQ	0.44	39	0.005
	PT	BAI	0.38	46	0.010
		BDI	0.35	46	0.017
		DHI	0.47	50	0.001
		PCLM	0.33	68	0.006
		PHQ	0.32	68	0.008

Table 5. (continued)

	OT	BDI	0.31	47	0.035
		PCLM	0.28	69	0.20
		PHQ	0.30	69	0.013
	MH	BAI	0.44	30	0.015
		BDI	0.59	30	0.001
		RBANS	-0.43	32	0.015
		SROP	-0.40	28	0.037
		PCLM	0.40	43	0.009
		PHQ	0.43	43	0.004
MCS	Mil	MACE	-0.46	39	0.003
	PT	PHQ	0.29	67	0.017
	OT	SROP	-0.36	43	0.017
	MH	DHI	0.43	36	0.008
		SOT	-0.46	28	0.014
TMS	Mil	PHQ	0.33	39	0.040
	PT	BAI	0.48	42	0.001
		BDI	0.40	42	0.010
		PCLM	0.34	61	0.008
	OT	DHI	0.32	48	0.026
		PHQ	0.31	62	0.015
	MH	BDI	0.45	32	0.009
		DHI	0.55	36	0.001
		SOT	-0.49	29	0.007
		PCLM	0.35	46	0.016
		PHQ	0.42	46	0.004
LNP	Mil	RBANS	-0.58	25	0.003
		MACE	-0.36	39	0.026
	OT	SOT	-0.47	39	0.003
		RBANS	-0.32	51	0.020
		SROP	-0.33	42	0.035
LN	PT	DVA Right	-0.39	33	0.024
EST CSS	MH	BDI	0.34	34	0.048
		DHI	0.45	37	0.005
		PCLM	0.31	51	0.030
		PHQ	0.46	51	0.001
Overall LOI		BDI	0.43	32	0.015
		PCLM	0.30	43	0.049
		PHQ	0.46	51	0.001
MH LOI		BAI	0.41	39	0.009
		BDI	0.48	39	0.002
		DHI	0.41	41	0.007

Table 5. (continued)

		RBANS	-0.37	40	0.018
		PCLM	0.40	55	0.003
		PHQ	0.48	55	< 0.001

Nonparametric comparisons

Mann-Whitney *U* tests were used to compare scores on the clinical measures significantly correlated with MFAP task ratings; comparisons were made between those who failed the MFAP versus those who passed. A total of 14 tests were run (clinical assessments included in the analyses were RBANS, SROP, BDI, Epworth Sleepiness Scale, AUDIT, BAI, DHI, SOT, PCLM, PHQ, CTMT, DVA-right, DVA-left, and MACE). The results supported rejecting the null hypothesis for RBANS ($U = 3.63$, $p < 0.001$), MACE ($U = 3.25$, $p = 0.001$), SROP ($U = 2.26$, $p = 0.024$), and PHQ ($U = -2.37$, $p = 0.018$), as those who passed the MFAP scored more favorably on these four assessments.

Leadership surveys

A total of 36 usable surveys were collected. Respondents were primarily commanders, first sergeants, platoon sergeants, and squad leaders. Twenty-two of the respondents (61.1 percent) were from an aviation brigade. The length of service ranged from 2 to 26 with a mean of 9.89 years. The frequencies of responses for each question are presented in table 6.

Table 6.
Leadership survey responses; frequency (percent)

	Very successfully	**Successfully**	**Neutral**	**Unsuccessfully**	**Very unsuccessfully**
In general, do Soldiers assigned to your unit who have been treated at an RRC reintegrate successfully into your unit?	4 (11.1)	11 (30.6)	13 (36.1)	8 (22.2)	0 (0)
	Yes, always	**Yes, sometimes**	**Yes, but very rarely**	**Never**	
In your opinion, do Soldiers assigned to your unit who have been treated at an RRC require special consideration or treatment to ensure successful reintegration?	5 (13.9)	22 (61.1)	9 (25)	0(0)	

Table. 6 (continued)

	Extensive	**Some**	**Very little**		
In your opinion, what level of special consideration or treatment do the Soldiers require to ensure successful reintegration?*	8 (22.2)	22 (61.1)	6 (16.7)		
	Very capable	**Capable**	**Neutral**	**Minimally capable**	**Incapable**
How capable do you feel these Soldiers are at performing their normal duties?	5 (13.9)	14 (38.9)	8 (22.2)	9 (25)	0 (0)
	Very capable	**Capable**	**Neutral**	**Minimally capable**	**Incapable**
In your opinion, are the Soldiers assigned to your unit who have been treated at an RRC perceived by their peers and comrades as capable of performing their duties?	5 (13.9)	16 (44.4)	7 (19.4)	8 (22.2)	0 (0)
	Very likely	**Likely**	**Neutral**	**Unlikely**	**Very unlikely**
How likely is it that these Soldiers will be an asset to the mission?	9 (25)	14 (38.9)	7 (19.4)	5 (13.9)	1 (2.8)
	Much better	**Better**	**Same**	**Worse**	**Much worse**
In general, how much improvement have you observed in these Soldiers' overall performance following treatment at the WRRC compared to before receiving treatment?	8 (22.2)	13 (36.1)	10 (27.8)	5 (13.9)	0 (0)

*Soldiers did not have an option to select "Never" or "None" for this question.

Discussion

The primary objective of this study was to evaluate the construct validity of the MFAP. We found that correlations between MFAP task ratings and clinical assessment scores demonstrate initial convergent validity with a number of commonly-employed cognitive and vestibular tests

that identify critical functioning deficits related to overall neurocognitive status, depression, anxiety, disorientation, alcohol use, and dynamic visual acuity. Comparisons between Soldiers who passed the MFAP and those who did not pass show that overall MFAP success is strongly tied to better scores on the RBANS, MACE, SROP, and PHQ, suggesting that the current MFAP tasks may represent skill sets that rely heavily on higher neurocognitive ability, high post-concussion functioning, positive self-perceived occupational performance, and fewer presenting depression symptoms.

Correlations between assessment scores and MFAP performance ratings from the three clinical raters often tended to coincide with the specialization of the rater (for example, the occupational therapist's MFAP ratings correlated with self-reported occupational performance of the Soldiers on four tasks [TCCC, WTBD, MCS, and LNP], but the same assessment only correlated with a rater other than the OT on two tasks [HEAT and VCOT]); however, correlations between clinical assessments and the military rater scores may provide valuable information related to preliminary predictive validity of the MFAP, as it will be an NCO or other military superior who will be rating Soldier performance according to a similar scale during active duty. The military rater scores correlated significantly with at least one clinical assessment for nearly every MFAP task, suggesting that many of the tasks successfully included a combination of abilities critical to both clinical and military functioning. The thorough inclusion of validated clinical tasks into existing Soldier exercises can increase the specificity of an instrument developed to detect exactly how a Soldier's injuries may affect his or her performance during active duty and/or combat. Those tasks that did not demonstrate a correlation between military ratings and clinical assessment outcomes included the HEAT, LN, and EST CSS. Currently, it is not possible to determine if or how a particular injury or condition may affect military-evaluated performance on any of these three tasks based on clinical assessment outcomes included in the WRRC patient battery. The predictive validity of these three tasks may benefit from further research into the inclusion of more clinically-significant tasks or activities (e.g., balance or memory tasks) performed in a military-relevant context.

The leadership surveys collected from military supervisors indicated generally positive perceptions of Soldier performance following treatment at the WRRC; however, the generalized nature of the questions and the small sample size of respondents make it difficult to make any large-scale inferences from the data. Considering that the majority of respondents believed that Soldiers reintegrating from the WRRC required some level of special consideration or treatment in order to be successful, and that 22 percent of respondents noted that the level of this special treatment was extensive, it would be of value to investigate these issues more specifically. Findings regarding special considerations are consistent with relatively high numbers of respondents who believed Soldiers to be only minimally capable of performing their normal duties after RTD (25 percent) and who believed that injured Soldiers were perceived to only be minimally capable by their peers (22.2 percent). Further research into leadership perceptions of Soldier performance after RTD should include more specific items regarding when and how special considerations must be made for injured Soldiers, and in what specific ways injured Soldiers are perceived to be minimally capable. Determinations of capability based upon Soldier MOS may also be useful, as Soldier requirements vary significantly across multiple occupational specializations.

As this was a preliminary analysis of archival data, there were a number of limitations to be addressed in any follow-up studies on the MFAP's validity. Data was inconsistently recorded, as clinical assessments were conducted only "as needed" based upon the participants' initial assessment findings. Since the data used for this study was de-identified, no follow-up was possible to determine the Soldiers' levels of success once returned to normal duty. Additionally, a study with greater control over data collection procedures (and therefore more consistent n values), would benefit from a post-hoc correction for multiple comparisons in order to avoid potential alpha error among such a large number of variables included in the correlation matrix.

Future Research

While the results of this study provide preliminary support for the MFAP, additional research is necessary to fully assess the efficacy of the program. Based upon findings of the present study, there are four recommendations for future research:

1. Longitudinal study of MFAP participants

In order to better analyze the relationships between clinical assessment outcomes and MFAP performance throughout the span of Soldier recovery, a longitudinal study is recommended. Controlled data collection from the intake phase of the MFAP into post-RTD performance will allow for more consistent data, while also providing preliminary data for assessing the relationship between MFAP scores and Soldier-reported post-RTD performance. A longitudinal study will also allow for evaluation of the MFAP's predictive validity. Determination of the predictive validity of the MFAP for acceptable post-RTD performance is a critical milestone of assessing it as an instrument. Future studies should investigate the relationship between MFAP scores and active duty evaluation variables (e.g., weapons qualification and counseling reports) to assess whether MFAP ratings accurately predict Soldier scores on currently-utilized military evaluation instruments.

2. Evaluation of test-retest reliability and inter-rater reliability of MFAP ratings

While the present study found that the MFAP demonstrates convergent validity with a number of clinical assessment instruments, additional metric properties must be established before the MFAP is proven to be a successful instrument for predicting Soldier performance after a head injury. An analysis of test-retest reliability must be run within-subjects on a significant clinical sample. Additionally, inter-rater reliability must be established for each of the four raters, especially the military rater, as his or her ratings follow a scale most directly related to the guidelines utilized for active duty Soldier performance evaluation.

3. Survey of special considerations commonly provided to injured Soldiers after returning to duty

Findings from the leadership survey indicated that a large number of military supervisors believe that injured Soldiers require special treatment in order to succeed after returning to duty; further, it was reported by approximately 16 percent of respondents that they did not consider it likely that Soldiers returning from a WRRC would be an asset to their units' missions. Further investigation into the special considerations offered to injured Soldiers, both in regard to the

magnitude of the special exceptions and the specific modifications made to the required task, should be implemented with a larger and more geographically diverse sample size. It may also be of interest to determine differences in special treatment given to injured Soldiers by MOS, as different specializations will require widely different cognitive, neurosensory, and physical abilities. Clarification regarding leadership opinions of injured Soldier value to the mission should also be a key focus of future research, as this directly conflicted with the fact that no survey respondents rated injured Soldiers as incapable of performing their normal duties, and zero respondents reported that injured Soldiers were perceived as being incapable by their peers.

Conclusions

The results of this study support the preliminary construct validity of the MFAP. Additionally, initial correlations between military-based performance ratings of MFAP tasks and clinical assessment outcomes were established for a majority of MFAP tasks; a valuable foundation for determining potential predictive validity of the MFAP for return-to-duty success and identifying specific effects of injuries on military performance in future research. A survey of military leadership uncovered broad perceptions related to the need for special considerations and treatment for injured Soldiers after returning to duty, but the limited sample size precludes the application of the findings to a broad military audience.

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